

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Sumie SUDA, et al. : Examiner Caitlin A. Fogarty

Serial No. 10/549,753

Filed September 21, 2005 : Group Art Unit 1793

for STEEL WIRE FOR HIGH

STRENGTH SPRING EXCELLENT IN

WORKABILITY AND HIGH STRENGTH

SPRING

DECLARATION UNDER 37. C.F.R. 1.132

Commissioner for Patents

Alexandria, VA 22313

Sir:

Now comes Noritoshi TAKAMURA, a citizen of Sagamihara-shi, Kanagawa-ken, Japan, who declares and states:

1. That I graduated from the Faculty of Engineering of Kyushu University in the year 1983.
2. That I have worked in NHK SPRING CO., LTD. for 26 years in the field of Valve spring Design & Development.

### 3. SUBJECT MATTER OF EXPERIMENTS

That I have conducted the following experiment to clarify that the spring steel combined HASHIMURA and "Fracture Toughness Properties--Effects of Microstructure and Heat treatment" of the Metals Handbook has the fatigue life inferior to the spring steel of the present invention.

### 4. EXPERIMENTAL REPORT

#### (I) Method:

Four fatigue tests were conducted until breakage with respect to the following test steel under a load stress of  $760 \pm 637$  MPa at the temperature of  $120^{\circ}\text{C}$ .

The chemical composition, mechanical properties and grain size of specimen (test steel) are as follows:

Chemical composition (mass%)

	C	Si	Mn	P	S	Ni	Cr	V	Al
Test steel	0.60	2.16	0.50	0.014	0.009	0.2	1.76	0.3	0.003
HASHIMURA	0.4	1.2	0.1			0.1	0.4	0.050	0.0001
	-0.7	-2.6	-0.42	-0.015	-0.015	-2.0	-2.0	-0.4	-0.006

Mechanical properties and Grain size

	$\sigma_{0.2}$ (MPa)	$\sigma_t$ (MPa)	$\sigma_{0.2} / \sigma_t$	Grain size number of prior austenite
Test steel	1931	2244	0.861	12.0
HASHIMURA	$\geq 1668$	$\geq 1960$	$\geq 0.8$	--

Notes)  $\sigma_{0.2}$  means 0.2% proof stress (Yield Strength), and  $\sigma_t$  means Tensile Strength.

$\sigma_{0.2}$  of HASHIMURA is calculated from its values \* $\sigma_t^*$  and \* $\sigma_{0.2} / \sigma_t^*$ .

## (II) Results

The results of fatigue tests are shown in Table 1.

Table 1

	Fatigue life ( $\times 10^6$ cycles)
Specimen 1	43
Specimen 2	44
Specimen 3	61
Specimen 4	80
Example Nos. 1-9 and 11-13 of the present specification	$\geq 100$

## (III) Consideration

The test steel has a chemical composition and mechanical properties within the range of HASHIMURA. The test steel also has a small grain size of prior austenite, which is taught by the Metals Handbook. The test steel is the combination of HASHIMURA and the Metals Handbook.

However, the fatigue lives of this test steel varies widely from  $43 \times 10^6$  to  $80 \times 10^6$  cycles, which are considerably shorter than the examples of No. 1-9 and 11-13 in the present specification (i.e., the present invention).

Accordingly, minimizing the prior austenite grain size for the high-strength spring steel disclosed in HASHIMURA to the size such as 12.0 does not increase the fatigue life of HASHIMURA to the level of the present invention.

The undersigned Petitioner declares further that all statements made herein of her own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Further declarant saith not.

Respectfully submitted,

Date: Dec. 14th 2009

Noritoshi Takamura  
Noritoshi TAKAMURA